SB
761
.U7
R6
no.95-1b

FOREST PEST MANAGEMENT

BIOLOGICAL EVALUATION R2-95-1

PEST CONDITIONS AT
CRESTED BUTTE MOUNTAIN RESORT,
TAYLOR RIVER/CEBOLLA RANGER DISTRIC
GUNNISON NATIONAL FOREST, COLORADO

United States
Department of
Agriculture

Forest Service

Forest Pest Management
Denver, Colorado

BIOLOGICAL EVALUATION R2-95-1

PEST CONDITIONS AT
CRESTED BUTTE MOUNTAIN RESORT,
TAYLOR RIVER/CEBOLLA RANGER DISTRICT,
GUNNISON NATIONAL FOREST, COLORADO

by: _____
Peter A. Angwin
Plant Pathologist, Acting Leader
Gunnison Service Center

Approved by: _____
Robert D. Averill
Leader, Forest Health Management

_____
J. Craig Whittekiend
Acting Director, Renewable Resources

FEBRUARY, 1995

National FS Library
USDA Forest Service

JUL 15 2011

240 W Prospect Rd
Fort Collins CO 80526

USDA Forest Service
Renewable Resources
Rocky Mountain Region
Gunnison Service Center
216 N. Colorado
Gunnison, Co. 81230

BIOLOGICAL EVALUATION R2-95-1

PEST CONDITIONS AT
CRESTED BUTTE MOUNTAIN RESORT,
TAYLOR RIVER/CEBOLLA RANGER DISTRICT,
GUNNISON NATIONAL FOREST, COLORADO

by: _____

Peter A. Angwin
Plant Pathologist, Acting Leader
Gunnison Service Center

Approved by: _____

Robert D. Averill
Leader, Forest Health Management

_____

J. Craig Whittekiend
Acting Director, Renewable Resources

FEBRUARY, 1995

USDA Forest Service
Renewable Resources
Rocky Mountain Region
Gunnison Service Center
216 N. Colorado
Gunnison, Co. 81230

EXECUTIVE SUMMARY

As part of the Forest Service's efforts to develop a vegetation management plan for the Crested Butte Mountain Resort ski area, surveys were carried out to assess the health of the spruce/fir, lodgepole pine, and aspen stands on Crested Butte. The survey consisted of two parts: an aerial survey to identify areas with dead and dying conifers, and a ground survey to investigate the causes of conifer mortality and assess the condition of the aspen stands on the mountain. Locations of the stands that were surveyed are given in Appendix A.

Symptoms typical of root disease were observed in 32 conifer stands. In all but two, symptoms were restricted to subalpine fir. Positive identification of Armillaria sp., the fungus that causes Armillaria root disease, was made in 16 stands. Evidence of bark beetles, probably western balsam bark beetle or the fir engraver beetle, was also noted in some root diseased firs. Lodgepole pine dwarf mistletoe was identified in four lodgepole pine and spruce/fir/lodgepole pine stands near the East River chair lift. In addition, nine aspen stands were identified with high levels of stem canker and decay.

In general, the pest problems observed at Crested Butte are typical of mature, non-managed stands. To minimize the effects of these pests in the future, vegetation management efforts need to concentrate on the gradual replacement of older stands with younger, more vigorous stands. This can be accomplished by the application of a series of thinning and regeneration cuts throughout the mountain. Treatments to address the specific pest situations may be integrated into this overall vegetation improvement effort.

Management alternatives to address specific insect and disease situations are presented for consideration. A combination of management activities is recommended. These include the institution of an annual hazard tree evaluation program, the selective removal and revegetation of root disease and dwarf mistletoe infection centers (together with the installation of buffer strips to prevent further disease spread), and the removal and regeneration of diseased aspen clones. Stand-specific recommendations are summarized in Appendix B.

In addition to the above vegetation management recommendations, it is further suggested that opportunities for interpretation be explored and implemented. These efforts will help to gain public understanding and acceptance of the various vegetation management actions as they are being implemented. Recommended interpretive options include the installation of signs where people congregate and/or a series of signs (an interpretive ski run) along one of the more highly-used ski runs. Summertime, interpretation may be implemented in connection with hiking and mountain biking activities. In addition, public involvement in replanting efforts may be encouraged.

INTRODUCTION

In May 1993, a multidisciplinary team was put together to develop a Vegetation Management Plan for the Crested Butte Mountain Resort (CBMR) ski area. As an appendix to the Ski Area Master Plan, the Vegetation Management plan sets forth alternatives and recommendations for the management of the vegetation within the boundaries of the Crested Butte Ski Area. In order to develop these management alternatives and recommendations, a detailed assessment of the health of the forest stands of the ski area was needed. As a result, the personnel of the Forest Health Management Gunnison Service Center were requested to develop and conduct an extensive survey to identify the location, distribution, and severity of insect and disease conditions at the ski area. An aerial survey, conducted in August 1993, was followed by a ground survey the following October. The following biological evaluation details the findings of the survey.

METHODS

Aerial Survey

On August 1, 1993, an aerial photo mission was flown by Dick Myhre, of the Forest Pest Management Methods Application Group. Six north/south-oriented flight lines were followed, covering the Crested Butte, Washington Gulch, and Snodgrass Mountain areas. Ninety-eight overlapping photos were taken, ranging in scale from approximately 1:8,000 (over high-elevation terrain) to 1:12,000 (over low-elevation terrain). In order to enhance the visibility of dead and dying trees, color infrared film was used. Following receipt of the infrared survey photos, stand locations and cover types were delineated within the ski area boundaries. Dead and dying coniferous trees (presumably affected by root disease or bark beetles) were then identified on the infrared photos by looking for individual and groups of white-to-cream-colored trees within the stands of normal, healthy red-colored trees.

Ground Survey

During the weeks of October 3 and 10, 1993, the individual and groups of off-colored trees on the infrared photos were located and inspected. Whenever possible, the cause of death or discoloration of dead or dying trees was determined. Trees with yellowing, red, or thinning crowns were checked for root disease by excavating at least two roots and looking under the bark for signs of disease-causing fungi. Because the photo interpretation of dead and dying trees concentrated on the spruce/fir and lodgepole pine stands, a sample of aspen stands was also visited and assessed for the presence or absence of insect and disease pests.

RESULTS

After accounting for photo overlap, a total of 34 coniferous stands were identified that contained dead or dying trees. Twenty-eight (82%) of these spruce/fir and lodgepole pine stands were visited and assessed for root disease and dwarf mistletoe. An additional 17 aspen stands were also

visited. The locations of these stands are shown in Appendix A. The results of the ground survey are summarized in Appendix B. Twenty-five of the stands that were visited were spruce/fir stands, although six contained significant numbers of lodgepole pine. The remaining three stands (Stands 23, 46 and 47) were composed primarily of lodgepole pine. Following are descriptions of the major insect and disease situations that were encountered.

Root Disease

Root disease symptoms (patches of dead and dying trees, trees broken from the roots or at the root collar, trees with thin or yellow crowns) were noted in all but one of the spruce/fir stands. In almost all of the stands, symptoms were restricted to the subalpine firs. In 16 of the stands, conclusive evidence of Armillaria root disease (white mycelial fans and/or rhizomorphs under the bark of the roots) was found. Except for one infected lodgepole pine sapling in Stand 47 and one down dead Engelmann spruce in Stand 22, Armillaria sp. was found only on subalpine fir. In two stands (Stand 11 and 30), evidence of bark beetle activity (exit holes, galleries under the bark) was also found in some of the older dead firs. Although the galleries were not distinct enough to positively identify the species of beetle involved, they were most likely caused by the western balsam bark beetle (Dryocetes confusus) or the fir engraver beetle (Scolytis ventralis). These beetles are commonly found in association with Armillaria root disease. Although only a few stands were specifically checked for the beetles, they are likely present in a number of other stands as well.

Dwarf Mistletoe

A large area along the eastern side of the East River ski runs is affected by lodgepole pine dwarf mistletoe (Arceuthobium americanum). The disease was noted in various concentrations in the three lodgepole pine stands (Stands 23, 46 and 47) and in the older lodgepole pines in the upper end of Stand 22. The location of the area affected by dwarf mistletoe is shown in Appendix A.

Dwarf mistletoe is particularly heavy in an infection center along the top edge of Stand 46 and the bottom edge of Stand 47, along the first 100 yards of the Black Eagle ski run. Lodgepole pines with Dwarf Mistletoe Ratings (DMRs) of 3-5 (Hawksworth 1977) are prevalent in this area, particularly in the overstory where some mortality has already occurred. In the lower portion of Stand 46, where the stand undergoes a transition from mixed lodgepole pine/spruce/fir to doghair lodgepole pine, is a large center with low-moderate dwarf mistletoe incidence (pines with DMRs of 1-2).

Stand 23, a doghair stand of lodgepole pine, is generally mistletoe-free, except in a well-defined disease center that is visible about 1/3 of the way down the Resurrection run. Within the center, pines with DMRs of 3-4 are not uncommon.

Stand 22 is undergoing a transition from lodgepole pine to spruce/fir, and dwarf mistletoe is one of the forces driving the transition. Dwarf mistletoe brooms were noted in many of the scattered older lodgepole pines.

Aspen Diseases

Most of the aspen stands that were viewed from the road while performing the ground survey appeared to be in good condition. However, incidence of cankers and stem decay is high in some stands. These conditions are mainly present in older stands or where excessive wounds have been inflicted by skiers or heavy machinery. During the walk-through examinations, nine aspen stands (Stands 65-66, 68-72, and 76-77) were identified that contained clones with high concentrations of cankers (black target canker (Ceratocystis fimbriata), sooty bark canker (Encoelia pruinosa), or Cryptosphaeria canker (Cryptosphaeria populina)) and/or aspen trunk rot (Phellinus tremulae). In another stand (Stand 67), excessive trunk rot in trees along the access road may pose a potential hazard. While ten diseased (out of seventeen surveyed) stands may seem to represent a major problem, it must be kept in mind that the only stands that were visited were ones that appeared from a distance to have a potential insect or disease problems.

MANAGEMENT ALTERNATIVES

1. Do Nothing. Under this alternative, mortality of the subalpine fir due to Armillaria root disease will continue. Although underground root disease spread is relatively slow, expansion of the root disease centers may proceed at a rate of approximately 1-2 feet per year. Within the root disease centers, regeneration of subalpine fir will be severely limited. New mortality will be particularly evident during years of drought. Additional mortality may also occur as populations of western balsam bark beetle or fir engraver beetle build up in the root-diseased trees and spread to adjacent healthy firs. Without active root disease management and replacement with more disease- resistant spruce, affected stands will continue to decline, resulting in increased hazard potential and impacting the aesthetic quality of the top half of the mountain.

Expansion of the dwarf mistletoe infection centers in the lodgepole pines near the East River chair lift will also continue, as the affected trees trees decline in health and vigor. Dwarf mistletoe spreads locally from tree to tree and to uninfected parts of the same tree by the expulsion of seeds from mature mistletoe fruits on infected trees. Though lateral spread of dwarf mistletoe centers averages only about 1-2 feet per year (Hawksworth and Johnson 1989), intensification of the disease within the centers will result in the probable failure of the stands to regenerate. Again, hazard potential and aesthetic qualities will be affected.

The disease problems that were observed in some of the aspen stands are common in mature-to-overmature aspen and in aspen stands that are subjected to excessive wounding. If the "do nothing" alternative is adopted, the diseased stands will continue to deteriorate. Additional stands will likewise become affected by stem decay and cankers as they get older.

2. Reduce Tree Hazard Potential. This alternative involves the implementation of a program of annual inspections to detect, identify and, remove hazard trees. The tree hazard evaluation proposed is best accomplished in three steps: identification, documentation, and corrective action. The evaluation is not merely a checkup of tree mortality;

identification of hazard trees entails the evaluation of both the probability of failure (tree defect evaluation) and the probability of injury or damage (target evaluation). Not all defective trees need to be removed; only those whose proximity to a target (such as lift lines, permanent structures, etc.) is such that the risk the tree poses outweighs the benefits it provides. In order to reduce liability, complete documentation of all hazard tree inspections is a necessity. An appropriate hazard tree assessment system for campgrounds has been developed by Johnson (1981). This system may be adapted for use at the ski area. In addition, a videotape by Sharon and Steinke (1989), "Tree Health Management: Evaluating Trees For Hazard," is available to help train inspection personnel.

3. Implement Root Disease/Bark Beetle Control. Under this alternative, steps would be taken to alleviate the root disease and bark beetle situation in the spruce/fir stands. Armillaria root disease spreads from tree to tree along root-root contacts, and diseased trees often take many years to show above-ground symptoms. Because of these factors, it may be assumed that many healthy-looking subalpine firs near visibly-infected trees and stumps are also infected by the fungus. For this reason, it is recommended that not only the visibly infected firs be removed, but also all firs within a buffer zone of 30-50 feet (50 feet is best). Although spruce and older lodgepole pine (greater than 25-years old) are also susceptible to Armillaria root disease, they appear to be more tolerant of the disease and thus may be retained within the disease centers and buffer zones. Spruce regeneration should also be silviculturally favored within the zones. If difficulties are encountered in regenerating the sites to spruce, active planting should be considered. Suitable planting stock may be obtained commercially or from the stands immediately adjacent to the ski area. Trees obtained from the latter source may be transplanted by use of a tree spade and should be taken no closer than 50 feet from a visibly infected tree. When using a tree spade, at least 10 inches of root ball radius is needed for each inch of tree diameter, as measured at the base. Intensive watering of the new transplants is critical.

Because Armillaria has the ability to survive for decades in infected stumps, it is often recommended that the stumps be removed from the ground. However, under the above management scenario, the fungus will likely remain in infected, though tolerant, standing spruce and lodgepole pines. Because of this, stump removal to cleanse the stands of the fungus is not recommended.

As stated previously, the relationship between Armillaria and the fir engraver and western balsam bark beetles is well known. The usual chain of events starts when Armillaria sp., present at low levels in the stand (and causing little damage), increases due to drought stress or disturbance. Beetle populations may then build up in the root disease centers to the point that additional trees outside the root disease centers are also attacked. Without the root disease, the bark beetles are seldom a problem. Therefore, any measures that are taken to address the root disease situation will also help to prevent future bark beetle problems. However, because beetle populations may also build up in fresh downed dead material, prompt removal of any live or recently killed trees that are cut is recommended. Trees that are cut from late spring to late fall need to be removed within 6 weeks. Those that are cut from late fall to winter may remain until the following spring.

4. Implement Dwarf Mistletoe Control. Under this alternative, dwarf mistletoe control measures would be undertaken in the infested lodgepole pine stands in the East River area. The objective of these measures would be to reduce the negative effects of the disease on tree vigor and longevity and to prevent disease spread into non-infested areas. Detailed guidelines for dwarf mistletoe control in developed recreation areas may be found in Hawksworth and Johnson (1989) and FPM (1990). In summary, appropriate management activities may include:

1. Broom Pruning - To extend tree life and maintain trees on the site for as long as possible.
2. Tree Removal - To selectively eliminate infested trees, prevent the buildup of bark beetles, and reduce dwarf mistletoe seed in the stand.
3. Branch Pruning/Eradication - To reduce or eliminate dwarf mistletoe seed in the stand and improve tree vigor.
4. Thinning - To improve stand growth and tree vigor.
5. Favoring and Planting of Non-Host Conifers and Hardwoods - To eventually replace infected trees with uninfected trees and lessen future spread of dwarf mistletoe.
6. Creation of Buffer Strips - To limit or stop the spread of dwarf mistletoe into a treated area from adjacent infested areas.
7. Application of Ethephon (an ethylene-releasing agent that causes dwarf mistletoe shoots to drop off host trees) - To prevent the spread of dwarf mistletoe seed during establishment of the understory until the infected overstory can be removed.

Of these measures, tree removal and the creation of buffer strips are the most effective for long-term dwarf mistletoe control. Because 90% of dwarf mistletoe seed is dispersed within 30 feet of infected trees and 98% is dispersed within 40 feet (Hawksworth and Graham 1963), buffer strips in which all lodgepole pines are removed should be 30-40 feet wide, depending on the degree of protection desired.

Control treatments are best done in conjunction with a program to replace removed trees. This may be accomplished either by favoring existing regeneration or by active replanting. Tree species that are not susceptible to lodgepole pine dwarf mistletoe, such as spruce or subalpine fir (subalpine fir where Armillaria root disease is not present or within 50 feet), should be favored whenever possible. Active replanting, following the same methods given above, is recommended wherever regeneration potential is low.

Not all infected trees need be immediately removed. However, if lodgepole pine is planted or allowed to regenerate under an infested overstory, then that overstory should be removed before any new pines reach 10 years of age. If the overstory is heavily infested, applications of ethephon (at 3-year intervals until the overstory is removed) may be appropriate.

5. Intensively Manage CBMR Aspen Stands. During the surveys, a number of aspen stands with high incidence of stem decay and cankers were observed. Patch-cutting and regeneration to new, disease-free aspen is the best available way to treat these stands. Besides reducing disease levels, an additional benefit would be to provide a badly-needed increase in the age-class diversity of the aspen vegetation component on the mountain. To encourage sprouting, cutting should encompass entire aspen clones (which are most easily visible in the spring and fall) and should open up patches

no smaller 2 tree heights in diameter. Input from a Landscape Architect should be sought to insure that the visual impacts of the cuts are minimized. To prevent wounding and allow the new aspen sprouts to become established, fencing should be installed around the cuts. The regeneration will likely need to be protected for a period of about 15 years. Information boards may be installed to discourage visitors from entering the regeneration areas, and explain what happens to the trees if they do.

6. A Combination of Alternatives 2, 3, 4 and 5. The above alternatives are not mutually exclusive. They are best used in combination to solve specific problems in many areas.

RECOMMENDATIONS

- Institute an annual hazard tree evaluation and removal program.

- Promote species and age-class diversity.

- Implement root disease/bark beetle control.

- Implement dwarf mistletoe control.

- Patch cut and regenerate overmature, diseased aspen clones.

- Explore and implement interpretive opportunities.

In a developed recreation setting, such as at Crested Butte Mountain Resort, a major objective of vegetation management is to create and perpetuate a healthy, diverse forest which is visually pleasing, minimizes tree hazard, and is less prone to damage by insects and disease. The best way to achieve this goal is by applying a variety of management activities to address the hazard tree, insect, and disease situations. Management Alternative 6 is therefore recommended.

Because of the extremely high year-round visitation on the mountain, the management of potential tree hazards needs to be a top priority. Although very few tree hazard situations were noted on the mountain, in order to keep up with the problem, an annual hazard tree inspection program needs to be maintained. Included in the program should be the identification and immediate removal of dead, dying, and highly defective trees within falling distance of permanent structures and human congregation points, as well as complete documentation of all inspection activities. The Forest Health Management specialists at the Gunnison Service Center are available to provide guidance in the implementation of the hazard tree program and to train the ski area management personnel in the recognition of potentially hazardous trees.

Overall, the pest problems observed on Crested Butte are typical of mature, non-managed stands. To minimize the impacts of these pests in the future, vegetation management efforts need to concentrate on the gradual replacement of older stands by younger, more vigorous stands. This can be accomplished by the application of a series of thinning and regeneration cuts throughout the mountain. Treatments designed to address specific pest situations may be integrated into this overall vegetation improvement effort.

Site-specific management recommendations to address the root disease, dwarf mistletoe, and aspen pest situations are given in Appendix B. Root disease treatments in specific stands are prioritized according to the amount of mortality and degree of activity that was observed. Stands with greater numbers of dying (yellow) and recently killed (red) firs were given high priority for treatment, while stands that contained mainly older Armillaria-infested snags were given moderate priority. Stands that are largely inaccessible were given low priority.

In general, the recommended treatment consists of the removal of all dead and dying root-diseased firs (exceptions to this are also in Appendix B). Installation of 50-foot wide buffer strips around the infection centers, in which all firs are removed, is also recommended. As stated previously, spruce and older (25+ years old) lodgepole pine may be retained in all treatment zones and spruce should be silviculturally favored as the replacement species. Younger regeneration may need additional protection by fencing or redirection of skier traffic.

In order to reduce the potential of fir engraver or western balsam bark beetle attack on the remaining subalpine firs, felled trees should be promptly removed from the site. Trees that are cut from late spring to late fall need to be removed within 6 weeks. Those that are cut from late fall to winter may remain until the following spring. As stated in the Management Alternatives section, treatments directed at the root disease problem will address potential bark beetle problems as well.

The degree to which the root disease/bark beetle treatments may be implemented will depend on visual considerations at each stand. If installation of a 50-foot wide buffer strip causes unacceptable aesthetic impact, consideration may be given to reducing the buffer zones to 30 feet, or eliminating them altogether. The tradeoff of reducing the buffer zones, however, would be the continuation of the subalpine fir mortality along the perimeter of the infection centers and a delay of the vegetative replacement within the centers with the more resistant spruce. Consultation with a Landscape Architect is again recommended.

In Stands 10 and 21, permanent plots have been installed as part of a westwide project to monitor the spread characteristics of Armillaria root disease. Because the objective of the study is to observe disease spread under management conditions, it is not necessary to delay the treatment of these stands. However, if and when these stands are treated, the staff of the Taylor River/Cebolla Ranger District and the Forest Health Management Gunnison Service Center will need to be notified.

To address the lodgepole pine dwarf mistletoe situation in the East River area, combinations of tree removals (sanitation thinning), creation of buffer strips, and the favoring or planting of non-host conifers are recommended. In the top edge of Stand 46 and the bottom edge of Stand 47, the dwarf mistletoe infestation is heavy enough that it is unlikely that it can all be removed in a single entry without seriously impacting visual quality. Removal of all infected overstory lodgepole pines and all understory pines with a DMR of 2 or more is therefore recommended. Where root disease is present, spruce should be favored and protected in all silvicultural operations. Where it is absent (and not present within 50 feet), subalpine fir may also be favored. Again, younger regeneration may

need additional protection by fencing or redirection of skier traffic. If some of the overstory lodgepole pines need to be retained for visuals or protection, then only the least infected pines (DMR < 2) or those where the infection is restricted to the bottom one-third of the crown should be retained. In any case, the remaining infested trees will need to be removed before the new understory trees reach 5 feet tall or 10 years old. Installation of a 40-foot buffer strip (removing all lodgepole pines) around the disease center is also recommended. This buffer treatment will remove all residual infections that will appear after the stand is opened up and prevent the disease from spreading to the rest of the stand. If the buffer zone is not established, the area around the cut will need to be closely monitored, and trees that show infection will need to be removed before the understory reaches 10 years old or 5 feet tall. In any case, the risk of allowing further spread of the disease is greatly increased.

In Stand 23 and in the lower portion of Stand 46 (in the transition zone from mixed lodgepole pine/spruce/fir to doghair lodgepole pine), complete removal of the dwarf mistletoe centers is definitely feasible. Removal of the lodgepole pine in the infection centers, together with the installation of 40-foot wide buffer strips is recommended. Again, spruce should be favored wherever possible, and subalpine fir may be favored where Armillaria is not within 50 feet.

In Stand 22, which is undergoing a transition from lodgepole pine to spruce/fir, removal of infested pines is the only dwarf mistletoe management measure that need be considered. Such a treatment would serve to protect any understory lodgepole pine that may regenerate in the stand. However, since the lodgepole pine component of the stand is dropping out, this treatment is given only moderate priority.

Finally, if a general thinning is applied to lodgepole pine, any additional dwarf mistletoe-infected trees that are found should be removed. Installation of additional buffer strips may also need to be considered.

While natural regeneration, favoring immune or disease-tolerant species (spruce and fir in mistletoe-infested areas and spruce in root disease pockets) will likely be used throughout most of the mountain, active planting may need to be considered in areas where establishment of new regeneration proves to be difficult. Again, use of a tree spade to bring in larger (up to 15 feet tall) healthy planting stock is recommended.

Management of the aspen component of Crested Butte should not be neglected as attention is focused on the spruce/fir and lodgepole pine stands. While most of the aspen is in relatively good shape as these stands grow older, more intensive management will be required. In the current survey, nine stands were identified that would benefit from immediate patch cutting and regeneration, and one additional stand (Stand 67) was identified where decay and canker-caused hazard is of immediate concern. We recommend that the situation in Stand 67 be immediately addressed and that patch cutting in the other nine stands be undertaken as soon as administratively feasible. Again, fencing should be installed to protect the new aspen sprouts from damage.

In the future, additional aspen stands will become affected by stem decay and cankers as they grow older. The condition of the aspen stands at CBMR should be monitored so that additional patch cuts may be implemented as needed.

To give the public a greater understanding of the vegetation management activities at CBMR, we further recommend that opportunities for interpretation be explored and exploited. Placement of signs on the mountain, or the installation of a series of interpretive signs along one of the more highly-used ski trails (an interpretive ski run), may be used to generate public awareness of what is being done by the Forest Service and the CBMR management to enhance forest health in the area. Signs along hiking and mountain bike trails may, in turn, convey the message to summertime users. Specific treatments may be explained and the efforts to enhance the long-term vegetative character of the area may be highlighted. The message that the forest is a dynamic, changing ecosystem, not a static, fixed one, may also be conveyed. Through these efforts, public support for the vegetative treatments may be generated. Additional signs may also encourage visitors to help in the overall effort by staying out of newly planted or regenerated areas and to refrain from damaging the trees. Public involvement from local or visiting groups in any replanting efforts that are carried out may also be solicited and encouraged.

LITERATURE CITED

FPM. 1990. Guidelines for the use of FPM funding for suppression of dwarf mistletoe in recreation areas. USDA For. Serv., Timber, For. Pest, and Coop. For. Mgmt., Letter to Forest Supervisors, File Desig. 3400, July 18, 1990. 7p.

Hawksworth, F.G. 1977. The 6-class dwarf mistletoe rating system. USDA For. Serv. Rocky Mtn. For. and Range Exp. Sta. Gen. Tech. Rep. 48. 7p.

Hawksworth, F.G. and D.P. Graham. 1963. Dwarf mistletoe on spruce in the Western United States. N.W. Sci. 37:31-38.

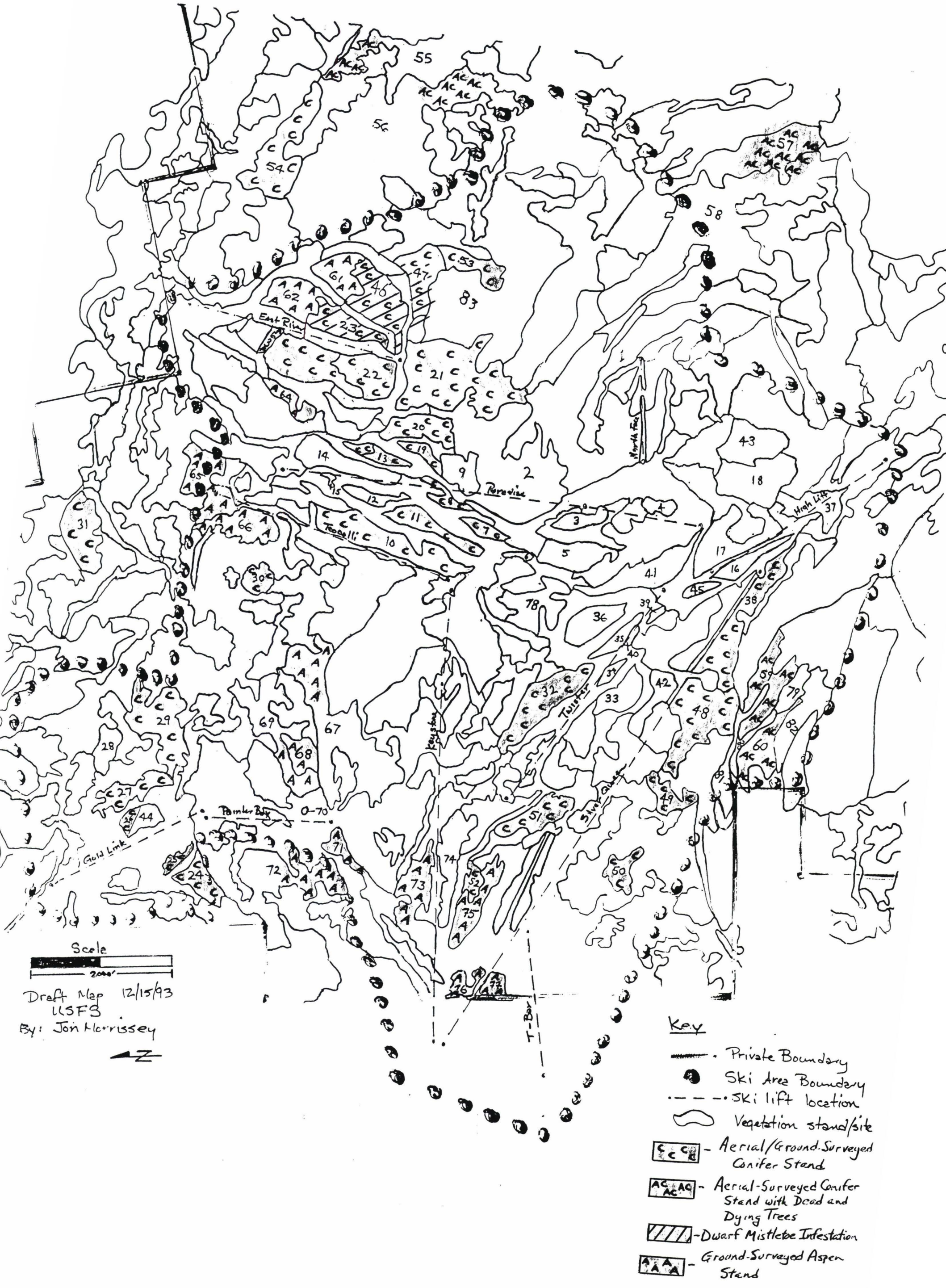
Hawksworth, F.G. and D.W. Johnson. 1989. Biology and management of dwarf mistletoe in lodgepole pine in the Rocky Mountains. USDA For. Serv., Rocky Mtn. For. and Range Exp. Sta. Gen. Tech. Rep. RM-169. 38p.

Johnson, D.W. 1981. Tree hazards - recognition and reduction in recreation sites. USDA For. Serv., Timber, For. Pest, and Coop. For. Mgmt. Tech Rep. R2-1. 17p.

Sharon, E.M. and D. Steinke. 1989. Tree health management: evaluating trees for hazard. VHS Video. Dist. by the Am. For. Assn. and the Int. Soc. of Arboriculture. 39 min.

APPENDIX A

Locations of surveyed stands
at Crested Butte Mountain Resort,
Taylor River/Cebolla Ranger District,
Gunnison National Forest.


Scale
2000'
Draft Map 12/15/93
USFS
By: Jon Morrissey
Key
Private Boundary
Ski Area Boundary
Ski lift location
Vegetation stand/site
- Aerial/Ground-Surveyed Conifer Stand
- Aerial-Surveyed Conifer Stand with Dead and Dying Trees
- Dwarf Mistletoe Infestation
- Ground-Surveyed Aspen Stand
East Rim
Paradise
Peerless
Gold Link
Painter Boy
Keystone
Tullytop
Silver Queen
North Face
High Lift
T-Bar

APPENDIX B

Tree disease conditions and
vegetation management recommendations
at Crested Butte Mountain Resort,
Taylor River/Cebolla Ranger District,
Gunnison National Forest.

TREE DISEASE CONDITIONS AND MANAGEMENT RECOMMENDATIONS IN SELECTED STANDS AT CRESTED BUTTE MOUNTAIN RESORT

STAND #	DOMINANT TREE SPECIES	GROUND-SURVEYED?	ROOT DISEASE SYMPTOMS	POSITIVE ID OF ARMILLARIA	DWARF MISTLETOE	MANAGEMENT RECOMMENDATIONS	TREATMENT PRIORITY
7	S/F	Y	Y-SAF	N	N	1	L1
8	S/F	Y	Y-SAF	Y	N	1	H
10	S/F	Y	Y-SAF	Y	N	1,9	H
11	S/F	Y	Y-SAF	Y	N	1	M
13	S/F	Y	Y-SAF	Y	N	1	H
19	S/F, SOME LPP	Y	N	N	N	3	H
20	S/F, SOME LPP	Y	Y-SAF	Y	N	1	M
21	S/F, SOME LPP	Y	Y-SAF	Y	N	1,9	H
22	S/F, SOME LPP	Y	Y- SAF, ES	Y	Y	1,4	M
23	LPP	Y	N	N	Y	5	H
24	S/F	Y	Y-SAF	N	N	1	M
25	S/F	Y	Y-SAF	N	N	1	M
26	S/F	Y	Y-SAF	N	N	1	M
27	S/F	Y	Y-SAF	N	N	1	M
28	S/F	Y	Y-SAF	N	N	1	M
30	S/F	Y	Y-SAF	Y	N	1	H
31	S/F, SOME LPP	Y	Y-SAF	Y	N	1	L2
32	S/F	Y	Y-SAF	N	N	1	M
38	S/F	Y	Y-SAF	Y	N	1	M
46	LPP, S/F	Y	Y-SAF	N	Y	1,5/6*	H
47	LPP, SOME S/F	Y	Y-LPP	Y	Y	2,6	H
48	S/F	Y	Y-SAF	Y	N	1	H
49	S/F, SOME A	Y	Y-SAF	Y	N	1	H
50	S/F	Y	Y-SAF	Y	N	1	H
51	S/F, SOME LPP	Y	Y-SAF	N	N	1	H
52	S/F, A	Y	Y-SAF	Y	N	1	H
53	S/F	Y	Y-ES	Y	N	1	L2
54	S/F, A	Y	Y-SAF	N	N	1	L2
55	S/F	N	Y	N	N	1	L2
56	S/F	N	Y	N	N	1	L2
57	S/F	N	Y	N	N	1	L2
58	S/F	N	Y	N	N	1	L2
59	S/F	N	Y	N	N	1	L2
60	S/F	N	Y	N	N	1	L2
61	A	Y	N	N	N	0	0

TREE DISEASE CONDITIONS AND MANAGEMENT RECOMMENDATIONS IN SELECTED STANDS AT CRESTED BUTTE MOUNTAIN RESORT (Cont.)

STAND #	DOMINANT TREE SPECIES	GROUND-SURVEYED?	ROOT DISEASE SYMPTOMS	POSITIVE ID OF ARMILLARIA	DWARF MISTLETOE	MANAGEMENT RECOMMENDATIONS	TREATMENT PRIORITY
62	A	Y	N	N	N	0	0
63	A	Y	N	N	N	0	0
64	A	Y	N	N	N	0	0
65	A	Y	N	N	N	7	M
66	A	Y	N	N	N	7	M
67	A	Y	N	N	N	8	H
68	A	Y	N	N	N	7	M
69	A	Y	N	N	N	7	M
70	A	Y	N	N	N	7	M
71	A	Y	N	N	N	7	M
72	A	Y	N	N	N	7	M
73	A	Y	N	N	N	0	0
74	A	Y	N	N	N	0	0
75	A	Y	N	N	N	0	0
76	A	Y	N	N	N	7	M
77	A	Y	N	N	N	7	M

LEGEND

STAND #- Where possible, stand number corresponds to site designations in Appendix B of the Crested Butte Mountain Resort Draft Vegetation Management Plan. Stands 46-78 were not included in the appendix.

DOMINANT TREE SPECIES- S/F = Mix of Engelmann spruce (Picea engelmannii) and subalpine Fir (Abies lasiocarpa). Minor components of Douglas-fir and/or lodgepole pine may also be present.

LPP = Lodgepole pine (Pinus contorta). Minor components of aspen, spruce and Douglas-fir may also be present.

A = Aspen (Populus tremuloides).

GROUND-SURVEYED?- Y = Stand was visited to confirm disease conditions.
N = Stand was not visited- information gained by photointerpretation.

TREE DISEASE CONDITIONS AND MANAGEMENT RECOMMENDATIONS IN SELECTED STANDS AT CRESTED BUTTE MOUNTAIN RESORT (Cont.)

ROOT DISEASE SYMPTOMS- Y = Presence of individual and groups of dead and dying trees, indicative of root disease. Additional symptoms include resinosus and whole-tree chlorosis (not individual branches).
N = Root disease symptoms not found
SAF = Root disease symptoms noted on subalpine fir
ES = Root disease symptoms noted on Engelmann spruce
LPP = Root disease symptoms noted on lodgepole pine

POSITIVE ID OF ARMILLARIA- Y = Armillaria root disease positively identified by the presence of rhizomorphs or mycelial fans on roots of symptomatic trees.
N = Signs of Armillaria root disease not found.

DWARF MISTLETOE- Y = Lodgepole pine dwarf mistletoe (Arceuthobium americanum) present in the stand.
N = Lodgepole pine dwarf mistletoe not found.

MANAGEMENT RECOMMENDATIONS- Note: In **ALL** stands, removal of high hazard trees (ie., dead snags within falling distance of permanent structures or highly used roads or ski runs) should be made a high priority. Hazard tree inspections and removals should be made every year, prior to the start of ski season.

0 = No silvicultural treatments necessary at this time.
1 = Remove dead and symptomatic (root disease-infected) subalpine fir and all fir within 50 feet of visibly infected trees. Favor spruce or lodgepole pine (where dwarf mistletoe is absent) in all silvicultural operations.
2 = Stand 47 has a single regenerating lodgepole pine with Armillaria root disease. Remove this tree and any subalpine fir within 25 feet.
3 = Remove only hazard trees (dead snags). Monitor for future appearance of root disease.
4 = Dwarf mistletoe is present, but stand is transitioning to spruce/fir. Remove all dwarf mistletoe-infected lodgepole pines. Where root disease is within 50 feet, favor spruce in all silvicultural operations. Where root disease is not within 50 feet, favor spruce and/or fir.
5 = Dwarf mistletoe is present in a nearly pure lodgepole pine stand. Remove all dwarf mistletoe-infected lodgepole pines and all lodgepole pines within 40 feet of infected trees. Favor spruce or fir in the understory wherever possible.
6 = Dwarf mistletoe incidence is too high to remove all of it in a single entry. Remove mistletoe-infested lodgepole pine overstory and remove understory lodgepole pines with a DMR (dwarf mistletoe rating) greater than 2. Where root disease is present, favor spruce in all silvicultural operations. Where root disease is within 50 feet, favor spruce in all silvicultural operations. Where root disease is not within 50 feet, favor spruce and/or fir. Install a 40-foot wide buffer strip (remove all lodgepole pines) around dwarf mistletoe infection center.
7 = Incidence of cankers and stem decay is high in some aspen clones. Patch cut and regenerate these clones.

TREE DISEASE CONDITIONS AND MANAGEMENT RECOMMENDATIONS IN SELECTED STANDS AT CRESTED BUTTE MOUNTAIN RESORT (Cont.)

8 = Incidence of cankers and trunk rot is low to moderate in some aspen clones. Remove only high hazard trees (dead or infected trees within falling distance of permanent structures, roads or ski runs) and monitor for additional mortality.

9 = Permanent study plots to monitor the spread of root disease have been installed in Stands 10 and 21. Because the objective of the study is to observe root disease spread under management conditions, deviation from management plans developed for CBMR are not necessary. However, if and when these stands are treated, please contact the Cebolla/Taylor River Ranger District and the Forest Health Management personnel at the Gunnison Service Center.

Additional note:

* Stand 46 has an area of highly mistletoe-infested lodgepole pines along the top of the stand. Treat this infection center as per Option #6 above. In the lower portion, where the stand undergoes a transition from mixed lodgepole pine/spruce/fir to "doghair" lodgepole pine, is an area with low-moderate mistletoe incidence. Treat as per Option #5 above.

TREATMENT PRIORITY-

0 = No treatments recommended.
L1 = Low Priority- A few scattered older snags are present in the stand. Does not appear to be caused by root disease.
L2 = Low Priority- Poor access and/or stand is located outside the ski area boundary.
M = Moderate Priority
H = High Priority